1972

Coastal bermudagrass pastures for grazing calves and yearlings in Louisiana

W M. Oliver

Coastal Bermudagrass Pastures for Grazing Calves and Yearlings In Louisiana

W. M. Oliver

LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
DOYLE CHAMBERS, DIRECTOR

letin No. 667

October 1972

PREFACE

Thousands of stocker calves and yearlings are produced annually in Louisiana. Many of these cattle are sold and shipped out of the state soon after weaning. Coastal bermudagrass is well adapted in Louisiana, especially in the Coastal Plain Region of the northern portion of the state. The studies reported here show that both calves and yearling cattle can be profitably carried through the growing phase of beef production on Coastal bermudagrass pastures in Louisiana.

Widespread adoption of the practice of grazing stocker cattle on well-managed Coastal bermudagrass pastures through the spring and summer months could mean millions of dollars in increased income to cattle producers in Louisiana.

CONTENTS

	Page
INTRODUCTION	5
MATERIALS AND METHODS	8
RESULTS	9
Animal Gains	9
Changes in Animal Value	13
Expenses, Income, and Net Returns	15
DISCUSSION	19
SUMMARY	22

Coastal Bermudagrass Pastures For Grazing Calves and Yearlings In Louisiana

W. M. Oliver[1]

INTRODUCTION

Cattle that are finally slaughtered as fed beef are carried through three production phases between birth and slaughter at 18 to 30 months of age. Until the calves are 6 to 9 months old, they are kept with their mothers and depend on both milk and forage for the nutrients required for preweaning growth. After weaning, the cattle are carried through a growing or stocker phase during which the increase in body size is composed primarily of skeletal and muscular growth. This production phase occurs during all or a part of the animal's life between 6 and 24 months of age. During this growing phase, the animals depend almost entirely on forage for the nutrients needed for growth because the primary purpose of this production phase is to increase body weight at a low cost. Following the stocker phase, the cattle are carried through a finishing or fattening period during which the primary objective is to improve the quality grade of the animal's carcass by increasing the fat content of its body. Fattening is, of course, accompanied by some increase in bone and muscle weight. To achieve the fattening necessary for improving the quality grade, the animal must be fed a ration containing a high proportion of grain for a period of 3 to 6 months. Today, about 80 percent of the cattle slaughtered in the United States are fed cattle weighing 950 to 1,150 pounds with a quality grade of High Good to Choice.

The growing or stocker phase of slaughter beef production is carried on in many different ways. Many cattle are grown with warm-season perennial grasses found on native range land of the Midwest

[1]Assistant Professor of Animal Science, North Louisiana Hill Farm Experiment Station, Homer, Louisiana.

and Southwest. The Osage Country of Oklahoma, the Flint Hills of Kansas, and the Sand Hills of Nebraska are well known as areas where stocker cattle are grazed. Other cattle are grazed on winter wheat fields in Western Texas, Oklahoma, and Kansas. Some are grown under feedlot conditions in the cattle finishing areas with high roughage rations such as silage. The objective is a reasonable increase in body size on relatively cheap feed.

A high percentage of the calves produced in beef cow herds of the Southeastern United States are sold at weaning time to stocker operators who carry them through the growing phase in other sections of the country. At the same time, the Southeastern United States has an advantage over other portions of the nation in its potential for forage production due to a longer growing season, more adequate rainfall, and soils which respond to fertilization. These natural advantages give this region the opportunity to carry calves through the stocker phase of production in an intensive and profitable manner. In recent years, a considerable number of stocker calves have been successfully grown in the Southeast by utilizing cool-season annual plants grown on cultivated land for forage. One of the objectives of this study was to evaluate the potential for growing stocker cattle in this region by using a warm-season perennial plant—Coastal bermudagrass—for forage.

Coastal bermudagrass is a warm-season perennial forage plant that was developed through extensive crossbreeding and selection by Dr. G. W. Burton of the Georgia Coastal Plain Experiment Station more than 20 years ago. It is widely adapted and is now grown throughout the entire Coastal Plain Region of the United States. Although it produces no viable seed, a cover of Coastal bermudagrass can be established rather easily in one growing season. Coastal bermudagrass may be grown on a wide range of soils and it will produce a large volume of forage when grown on the poorer upland soils of the Coastal Plain because it responds efficiently to high levels of fertilization. Coastal bermudagrass can be grown on soils on steep slopes because the plants produce a thick mat of stems and roots which prevent erosion. Thus, thousands of acres of land in the Southeastern United States that would otherwise be limited to use by woody vegetation may now be used for forage production. Because it produces a very deep root system, Coastal bermudagrass will continue to make rather satisfactory growth during periods of subnormal rainfall when growth by other warm-season forage plants ceases. It seems virtually impossible to kill Coastal bermudagrass by overgrazing if satisfactory fertility levels are maintained.

The forage producing potential of Coastal bermudagrass has been thoroughly tested by experiment stations throughout the South. When compared with other adapted perennials in hay production studies,

Coastal bermudagrass has consistently produced 25 to 50 percent more forage per acre. With proper management and fertilization, up to 8 tons of hay per acre have been harvested without irrigation.

The nutritive value of properly managed and harvested Coastal bermudagrass hay has been found to be excellent, with a digestible protein content of 14 to 18 percent and digestible dry matter content above 60 percent. The potential of Coastal bermudagrass in terms of the production of feed nutrients per acre compares very favorably with most grain and forage crops. In one study, two cuttings of properly harvested Coastal bermudagrass hay yielded the same amount of digestible dry matter and twice as many pounds of digestible protein per acre as are contained in 100 bushels of corn. Coastal bermudagrass is widely adapted in the Southeast. It produces a large volume of forage. When properly managed, the forage is high in nutritional value. It appeared logical that the potential of Coastal bermudagrass to provide forage for growing stocker cattle should be evaluated.

The response of stocker cattle grazed on Coastal bermudagrass has been studied in only a limited manner. It has generally been found that beef gain per acre and the number of animal days of grazing obtained from Coastal bermudagrass pastures have been greater than were obtained from other warm-season perennial plants. These findings were largely the result of a greater volume of forage being produced and more animals being grazed. But researchers and producers alike have generally reported that beef gains per animal have been less than desirable, particularly during the latter portion of the grazing season and when younger cattle were grazed. In view of the excellent nutritive content of properly managed and harvested Coastal bermudagrass that has been observed, there seemed to be a possibility that the less than desirable animal performance might have resulted from less than desirable management of the forage rather than the grass itself. It has been observed in hay evaluation that forage harvested when the plant growth was young contained a higher proportion of digestible protein and digestible dry matter than forage harvested when the growth was older. Therefore, it was hypothesized that applying management practices to the grazing of Coastal bermudagrass that would help keep the vegetative plant parts young and immature should result in the production of satisfactory beef gains per animal and per acre. Thus, another objective of this study was to compare the beef gain and returns obtained from a rotational grazing system with that produced by the conventional continuous grazing system.

MATERIALS AND METHODS

Two Coastal bermudagrass pastures, each 10 acres in size, were used in grazing trials during the spring and summer of 1969, 1970, and 1971 to compare weight gains of stocker calves and yearlings grazed continuously and on a rotational system. One pasture was fenced so that the forage in the entire pasture was available for grazing on a continuous basis. The other pasture was crossfenced into four paddocks, each 2.5 acres in size, so that grazing by the cattle could be more systematically regulated by rotating the animals from paddock to paddock. Under the rotation system used, all the cattle were grazed on one paddock at a given time. The animals were systematically moved to a fresh 2.5-acre paddock each Monday morning, Wednesday afternoon, and Friday afternoon. In following this system of rotation, each paddock was grazed approximately 3 days and allowed a period of 10 days for regrowth. Hay was harvested from both pastures when observation indicated that surplus forage was present and needed to be removed to keep the grass in a young, nutritious condition.

In the 1969 and 1971 trials, yearling Hereford steers were grazed. The steers had been weaned the previous fall and wintered to make essentially no weight gain. Spring weaned Hereford steer and heifer calves were grazed in the 1970 trial.

The stocking rates used for the two grazing systems were equal within each trial. The stocking rates used in each of the three trials are shown in Table 1. Under these stocking rates, the grazing pressure on a paddock being grazed under the rotational system was 4.8 yearlings or 2,136 pounds initial liveweight per acre in 1969, 11.2 calves or 3,580 pounds initial liveweight per acre in 1970, and 5.6 yearlings or 2,672 pounds initial liveweight per acre in 1971.

Phosphate and potash were applied to both pastures in March each year based on needs as indicated by soil tests. Each year 300 pounds of 0-20-20 fertilizer per acre was used. In 1969, each pasture was topdressed with 200 pounds of ammonium nitrate per acre on April 1 and near the first of each succeeding month through

TABLE 1.—Stocking Rates for the Continuous and Rotation Grazing Systems During 1969, 1970, and 1971

Year	Kind of cattle	Head per acre	Initial liveweight per acre, lb.	
			Continuous	Rotation
1969	Yearling steers	1.2	530	534
1970	Steer and heifer calves	2.8	873	895
1971	Yearling steers	1.4	618	668

August 1—a total of 1,000 pounds of ammonium nitrate per acre. In 1970, grazing was not initiated until May 13 following weaning of the calves. The first application of ammonium nitrate was therefore delayed until May 1, when 200 pounds per acre was applied. An additional 200 pounds of ammonium nitrate per acre was applied near July 15. In 1971, the pastures were topdressed with 200 pounds of ammonium nitrate per acre on April 1 and on July 1.

In the 1969 and 1971 trials, grazing was initiated as soon as observation indicated a reasonable supply of forage. This occurred on April 1 in 1969. Cool temperatures delayed plant growth in the spring of 1971 so that ample forage was not available before April 15. The 1970 trial was not initiated until May 13 following weaning of the calves at an average age of 218 days. Grazing was terminated in the fall when it became apparent that the cattle were no longer gaining weight. The date that this occurs in any year is largely dependent on the prevalence of rainfall in July, August, and September. The termination date was August 29 in 1969, October 1 in 1970, and September 17 in 1971. This resulted in a grazing period of 150 days in 1969, 141 days in 1970, and 154 days in 1971.

RESULTS

Animal Gains

1969 Trial. The average weight gains made by the yearling steers on the two grazing systems during the 150-day grazing period in 1969 are presented in Table 2. This table also shows the gains made by the cattle during various portions of the grazing period. The following important facts are demonstrated in this table:

1. Continuous grazing produced more weight gain during the 90-day period between April 1 and July 1 than was obtained from rotation grazing. During this period, the steers gained an average of 2.25 and 2.06 pounds per day, 203 and 186 pounds per head, and 244 and 223 pounds per acre on the continuous and rotational systems, respectively.

2. Rotation grazing produced more gain during the following 60-day period from July 1 to August 29 than did continuous grazing. Over this portion of the grazing season, the steers made an average gain of 1.46 and 0.55 pounds per day, 88 and 33 pounds per head, and 106 and 40 pounds per acre on the rotational and continuous systems, respectively.

3. Over the entire 150-day grazing period, the rotationally grazed steers averaged 0.25 pound per day, 38 pounds per head, and 45

pounds per acre more than the continuously grazed animals. This advantage for rotation grazing was produced during the last 60 days of the grazing season.

4. Both groups of steers made average daily gains in excess of 1.5 pounds over the 150-day grazing period. During this entire period the steers produced 329 and 284 pounds of beef gain per acre on the rotational and continuous systems, respectively.

TABLE 2.—Average Weight Gains Made by Yearling Steers Grazed on Coastal Bermudagrass During the 1969 Grazing Season (stocking rate 1.2 steers—532 lb. per acre)

Period	Days	Gain, pounds		
		Head	Daily	Acre
—Rotation grazing—				
April 1 to June 1	60	102	1.70	123
June 1 to July 1	30	84	2.80	100
April 1 to July 1	90	186	2.06	223
July 1 to August 1	31	40	1.29	48
August 1 to August 29	29	48	1.66	58
July 1 to August 29	60	88	1.46	106
April 1 to August 29	150	274	1.82	329
—Continuous grazing—				
April 1 to June 1	60	150	2.50	180
June 1 to July 1	30	53	1.76	64
April 1 to July 1	90	203	2.25	244
July 1 to August 1	31	8	0.26	10
August 1 to August 29	29	25	0.86	30
July 1 to August 29	60	33	0.55	40
April 1 to August 29	150	236	1.57	284
Advantage for rotation system		38*	0.25*	45*

*$P < .05$.

1970 Trial. The performance of the spring weaned calves that were grazed in the 1970 trial is shown in Table 3. These data reveal the following important facts:

1. There was no difference in the gains made by the calves on the two grazing systems during the first 48 days of grazing from May 13 to June 30. During this period, both groups of calves averaged 1.10 pounds per day, 53 pounds per head, and 148 pounds per acre.

2. Rotation grazing produced more weight gain during the 64 days between June 30 and September 2. Over this period the calves

TABLE 3.—Average Weight Gains Made by Spring Weaned Calves Grazed on Coastal Bermudagrass During the 1970 Grazing Season (Stocking rate 2.8 calves—884 lb. per acre)

Period	Days	Gain, pounds		
		Head	Daily	Acre
—Rotation grazing—				
May 13 to June 30	48	53	1.10	148
June 30 to Sept. 2	64	46	0.72	128
Sept. 2 to Oct. 1	29	16	0.55	46
May 13 to Oct. 1	141	115	0.82	322
—Continuous grazing—				
May 13 to June 30	48	52	1.08	147
June 30 to Sept. 2	64	32	0.50	89
Sept. 2 to Oct. 1	29	2	0.06	6
May 13 to Oct. 1	141	86	0.60	242
Advantage for rotation grazing		29*	0.22*	80*

*$P < .05$.

averaged 0.72 and 0.50 pound per day, 46 and 32 pounds per head, and 128 and 89 pounds per acre on the rotational and continuous systems, respectively.

3. During the month of September the continuously grazed calves made essentially no weight gain, while the rotationally grazed animals averaged 0.55 pound per day.

4. Over the entire 141-day grazing period, the rotationally grazed calves averaged 0.22 pound per day, 29 pounds per head, and 80 pounds per acre more than the continuously grazed calves. This advantage for rotation grazing was produced during that portion of the grazing period after June 30.

5. The calves in this trial gained an average of less than 1 pound per day. It is important to note, however, that 2.8 rotationally grazed calves produced 322 pounds of gain per acre. This was essentially the same gain per acre as was produced by 1.2 rotationally grazed yearling steers in the 1969 trial.

1971 Trial. The average weight gains for the yearling steers grazed on the two systems in the 1971 trial are summarized in Table 4. This summary points up the following important facts:

1. The rotationally grazed steers produced slightly larger gains during the 84 days from April 15 to July 9 than those grazed continuously. The average gains during this period were 2.25 and 2.04 pounds per day, 189 and 171 pounds per head, and 265 and 240 pounds per acre for the rotational and continuous systems, respectively. The average daily gains for the two systems were 2.75 and 2.29 pounds dur-

TABLE 4—Average Weight Gains Made by Yearling Steers Grazed on Coastal Bermudagrass During the 1971 Grazing Season (Stocking rate 1.4 steers—643 lb. per acre)

Period	Days	Gain, pounds		
		Head	Daily	Acre
	—Rotation grazing—			
April 15 to May 28	42	116	2.75	162
May 28 to July 9	42	74	1.75	103
April 15 to July 9	84	189	2.25	265
July 9 to Aug. 20	42	56	1.33	78
Aug. 20 to Sept. 17	28	28	1.02	40
July 9 to Sept. 17	70	84	1.21	118
April 15 to Sept. 17	154	274	1.78	384
	—Continuous grazing—			
April 15 to May 28	42	96	2.29	134
May 28 to July 9	42	75	1.79	105
April 15 to July 9	84	171	2.04	240
July 9 to Aug. 20	42	64	1.52	89
Aug. 20 to Sept. 17	28	22	0.78	31
July 9 to Sept. 17	70	86	1.22	120
April 15 to Sept. 17	154	257	1.67	360
Advantage for rotation system		17 n.s.	0.11 n.s.	24 n.s.

n.s. Not significantly different from zero.

ing the 42-day period between the initiation of grazing on April 15 and May 28.

2. The gains for the two grazing systems were essentially equal during the 70-day period after July 9. The weight gains per acre during this period averaged 118 and 120 pounds for the rotational and continuous systems, respectively. These gains were larger than the gains produced during the latter portion of the grazing season by either system in the 1969 and 1970 trials.

3. There was a slight, but nonsignificant, advantage in weight gain produced by the rotational system over the entire 154-day grazing period. During the entire grazing season, the steers gained an average of 1.78 and 1.67 pounds per day, 274 and 257 pounds per head, and 384 and 360 pounds per acre on the rotational and continuous systems, respectively.

Changes in Animal Value

A producer who grazes stocker cattle is interested in the change in value of the animals from the beginning to the end of the grazing season. The change in animal value is influenced by both weight gain and margin. Margin is the difference between the initial and final market prices of the cattle per hundredweight. When the final price is higher than the initial price, the margin is positive and there is an increase in the value of the initial weight of the animal. When the final price is lower than the initial price, the margin is negative and there is a decrease in the value of the initial animal weight. Margin, therefore, is important to the economics of grazing stocker cattle. The influence that margin has on the change in value of the cattle is dependent upon the changes that occur in market prices from the beginning to the end of the grazing season. These changes in market price vary from year to year. Usually, however, the producer must operate on a negative margin because the market price per hundredweight often decreases as animal weight increases. Thus, if the net value of the animal is increased through the grazing season, the value of the increase in gain must more than offset the decrease in value of the initial weight resulting from negative margin.

The cattle grazed in these trials were evaluated by an order buyer at the beginning and the end of the grazing season in each year and the market price of the cattle was established. With these prices, the influences of weight gain and margin on the net changes in animal values were computed for each grazing system. These changes in value are shown in Tables 5, 6, and 7 for the 1969, 1970, and

TABLE 5.—Average Changes in Value of Yearling Steers Grazed on Coastal Bermudagrass During the 1969 Grazing Season

Item	Rotation grazing	Continuous grazing
Initial wt., lb.	445	441
Initial value/cwt., dollars	30.70	30.70
Initial value/head, dollars	136.61	135.46
Final weight, lb.	719	678
150-day gain/head, lb.	274	237
150-day gain/acre, lb.	329	284
Final value/cwt., dollars*	28.80	28.80
Final value/head, dollars	207.12	195.24
Change in value/head due to gain, dollars	78.96	68.16
Change in value/head due to margin, dollars	−8.45	−8.38
Net change in value/head, dollars	70.51	59.78
Change in value/acre due to gain, dollars	94.75	81.79
Change in value/acre due to margin, dollars	−10.14	−10.06
Net change in value/acre, dollars	84.61	71.73

*Margin: −$1.90.

1971 trials. The following important points are demonstrated in these data:

1. The margin was negative in all three years. The margin was -$1.90 in 1969, -$1.32 in 1970, and -$1.06 in 1971.

2. The negative margin was essentially equal for both grazing systems in all years.

3. The positive influence of weight gain was much more important in determining the net increase in animal value than was the negative influence of margin in the three years covered by these trials.

4. Rotation grazing produced a larger net change in value per head and per acre than continuous grazing. This was the result of the greater weight gains produced by the rotational system.

It is emphasized that the relationship between the influence of margin and weight gain in determining the net change in animal value during the grazing season is a function of market prices. The facts reported above are specific for the three years in which these trials were conducted. Any change in the relationship between the initial and final market price will result in a change in the influence of margin on the net change in animal value from the beginning to the end of the grazing season.

TABLE 6—Average Changes in Value of Spring Weaned Calves Grazed on Coastal Bermudagrass During the 1970 Grazing Season

Item	Rotation grazing	Continuous grazing
Initial wt., lb.	320	312
Initial value/cwt., dollars*	32.40	32.58
Initial value/head, dollars	103.58	101.60
Final wt., lb.	435	398
141-day gain/head, lb.	115	86
141-day gain/acre, lb.	322	242
Final value/cwt., dollars*	31.12	31.22
Final value/head, dollars	135.26	124.30
Change in value/head due to gain, dollars	35.86	27.00
Change in value/head due to margin, dollars	−4.51	−4.28
Net change in value/head, dollars	31.35	22.72
Change in value/acre due to gain, dollars	100.40	75.60
Change in value/acre due to margin, dollars	−12.62	−11.98
Net change in value/acre, dollars	87.78	63.62

*Average for all calves. Prices and margin for the four sex-weight groups were:

Group	Initial price (5-13-70)	Final price (10-1-70)	Margin
Heavy steers	$32.00	$32.50	+$0.50
Light steers	37.00	35.00	− 2.00
Heavy heifers	30.00	27.50	− 2.50
Light heifers	32.00	30.00	− 2.00
Rotation grazing	32.40	31.12	− 1.28
Continuous grazing	32.58	31.22	− 1.36

TABLE 7.—Average Changes in Value of Yearling Steers Grazed on Coastal Bermudagrass During the 1971 Grazing Season

Item	Rotation grazing	Continuous grazing
Initial wt., lb.	476	442
Initial value/cwt., dollars	34.66	34.98
Initial value/head, dollars	164.92	154.57
Final wt., lb.	750	699
154-day gain/head, lb.	274	257
154-day gain/acre, lb.	384	360
Final value/cwt., dollars*	33.54	33.98
Final value/head, dollars	251.52	237.60
Changes in value/head due to gain, dollars	91.86	87.60
Change in value/head due to margin, dollars	−5.27	−4.58
Net change in value/head, dollars	86.60	83.02
Change in value/acre due to gain, dollars	128.60	122.64
Change in value/acre due to margin, dollars	−7.38	−6.41
Net change in value/acre, dollars	121.24	116.22
*Margin	−$1.12	−$1.00

Expenses, Income, and Net Returns

The average expenses, income, and net returns per animal and per acre for both grazing systems in each of the three grazing trials are presented in Tables 8, 9, and 10. The income includes both the value of the cattle at the end of the grazing season and the value of the hay harvested. The expenses include all costs involved in growing the forage, the cost of the cattle, and the interest on capital invested in cattle. The net return shown is the return to land and management. The net return figures, therefore, reflect the cost for the use of land. The data presented in these tables demonstrate the following important findings:

1. In each of the three years, the expenses were essentially equal for the two grazing systems. The principal differences were the cost item of $1 per acre per year charged for additional fencing, water facilities, and labor required for the rotation grazing system, the cost of harvesting hay, and the slightly heavier initial weight of the rotationally grazed cattle.

2. The costs per pound of gain in the 1969 trial were 19.7¢ and 22.5¢ for rotation and continuous grazing, respectively. In 1970, these costs were 12.5¢ and 13.2¢ for the two grazing systems. In 1971, one pound of gain was produced at a cost of 8.3¢ under both systems. In calculating these costs per pound of gain, the expense of producing and harvesting the hay was included.

3. The returns from the sale of cattle were larger for the

TABLE 8.—Expenses, Income, and Net Returns to Land and Management for Rotation and Continuous Grazing for the 1969 Trial with Yearling Steers

	Rotation grazing		Continuous grazing	
	Per animal	Per acre	Per animal	Per acre
Expenses				
300 lb. 0-20-20 @$70/ton	$ 8.75	$ 10.50	$ 8.75	$ 10.50
1,000 lb. 33- 0- 0 @$50/ton	20.83	25.00	20.83	25.00
Fertilizer application	5.00	6.00	5.00	6.00
Additional fencing, water, labor	0.83	1.00	—	—
Initial cost of steers @$30.70	136.61	163.93	135.46	162.55
Interest on investment in calves @6%	3.36	4.03	3.34	4.00
Marketing costs on cattle	8.78	10.54	8.22	9.86
Harvesting hay @$10/ton	6.66	8.00	7.08	8.50
Total expenses	$190.82	$229.00	$188.68	$226.41
Expenses less calf costs	$ 54.21	$ 65.07	$ 53.22	$ 63.86
Income				
Rotation grazing				
Sale of steers @$28.80	$207.12	$248.54		
0.80 ton hay @$20/ton	13.33	16.00		
Continuous grazing				
Sale of steers @$28.80			$195.24	$234.28
0.85 ton hay @$20/ton			14.16	17.00
Total returns	$220.45	$264.54	$209.40	$251.28
Net returns to land and management	$ 29.63	$ 35.54	$ 20.72	$ 24.87

rotational system in all three years. This was the result of the larger weight gains produced by rotation grazing.

4. More hay was harvested from the pasture that was grazed rotationally in two of the three years. This was primarily due to the fact that the grazing and haying could be managed with more precision under the rotational system.

5. Rotation grazing produced $11.05 per head and $13.26 per acre more income than continuous grazing in 1969. The advantage in income for rotation grazing in 1970 was $16.31 per head and $44.71 per acre. In 1971, the income produced by rotation grazing was $24.92 per head and $34.88 per acre greater than the income from continuous grazing.

6. The differences between the income and expenses are shown in the tables as net returns to land and management. In 1969, the net returns were $29.63 and $20.72 per head and $35.54 and $24.87 per acre for the rotational and continuous systems, respectively. The two grazing systems produced net returns of $24.07 and $12.69 per head and $66.43 and $35.57 per acre in 1970. In 1971, the net returns from rotation grazing were $88.00 per head and $107.89 per acre, while

TABLE 9.—Expenses, Income, and Net Returns to Land and Management for Rotation and Continuous Grazing for the 1970 Trial with Spring Weaned Calves

	Rotation grazing		Continuous grazing	
	Per animal	Per acre	Per animal	Per acre
Expenses				
300 lb. 0-20-20 @$70/ton	$ 3.75	$ 10.50	$ 3.75	$ 10.50
400 lb. 33-0-0 @$50/ton	3.57	10.00	3.57	10.00
Fertilizer application	1.07	3.00	1.07	3.00
Additional fencing, water, labor	0.36	1.00	—	—
Initial cost of calves*	103.58	290.04	101.60	284.47
Interest on investment in calves @6%	2.41	6.76	2.31	6.48
Harvesting hay @$10/ton	3.21	9.00	0.71	2.00
Total expenses	$117.95	$330.30	$113.02	$316.45
Expenses less calf costs	$ 14.37	$ 40.26	$ 11.42	$ 31.98
Income				
Rotation grazing				
Sale of calves*	$135.60	$378.73		
0.9 ton hay @$20/ton	6.42	18.00		
Continuous grazing				
Sale of calves*			$124.29	$348.02
0.2 ton hay @$20/ton			1.42	4.00
Total returns	$142.02	$396.73	$125.71	$352.02
Net Returns to land and management	$ 24.07	$ 66.43	$ 12.69	$ 35.57

*Prices per pound:	Initial (5/13/70)	Final (10/1/70)
Heavy steers	32¢	32.5¢
Light steers	37¢	35.0¢
Heavy heifers	30¢	27.5¢
Light heifers	32¢	30.0¢

the net returns from the continuous system were $74.91 per head and $96.53 per acre. While rotation grazing produced greater returns to land and management than continuous grazing in all years, it is important to note that continuous grazing produced substantial returns.

The financial data presented for the three trials in Tables 8, 9, and 10 are summarized in Table 11. The values shown in Table 11 are averages of the three years. These values reflect the following important facts:

1. A somewhat larger investment was required for the rotational system. The expenses per acre, including animal costs, averaged $279.18 for rotation grazing and $265.86 for continuous grazing, $13.32 more for rotation grazing. A part of this difference was due to the slightly heavier initial weight of the animals used on the rotational system.

2. The net returns to land and management per acre averaged $69.94 and $52.32 for the rotational and continuous systems, re-

TABLE 10.—Expenses, Income, and Net Returns to Land and Management for Yearling Steers Grazed on Coastal Bermudagrass During the 1971 Grazing Season

	Rotation grazing		Continuous grazing	
	Head	Acre	Head	Acre
Expenses				
300 lb. 0-20-20 @$70/ton	$ 7.50	$ 10.50	$ 7.50	$ 10.50
400 lb. 33- 0- 0 @$50/ton	7.14	10.00	7.14	10.00
Fertilizer application	2.14	3.00	2.14	3.00
Additional fencing, water, labor	0.71	1.00	—	—
Initial cost of steers[1]	164.92	230.88	154.57	216.40
Interest on investment in calves @6%	4.18	5.85	3.96	5.54
Harvesting hay @$10/ton	1.21	17.00	0.66	9.27
Total expenses	$187.80	$278.23	$175.97	$254.71
Expenses less steer costs	$ 23.00	$ 47.35	$ 21.40	$ 38.31
Income				
Rotation grazing				
Sale of steers[2]	$251.52	$352.12		
1.7 ton hay @$20/ton	24.28	34.00		
Continuous grazing				
Sale of steers[2]			$237.60	$332.64
0.93 ton hay @$20/ton			13.28	18.60
Total returns	$275.80	$386.12	$250.88	$351.24
Returns to land and management	$ 88.00	$107.89	$ 74.91	$ 96.53
[1]Avg. initial price/cwt.	$ 34.66		$ 34.98	
[2]Avg. sale price/cwt.	$ 33.54		$ 33.98	

TABLE 11.—Average Expenses, Income, Net Returns to Land and Management, and Cost Per Pound of Gain for Rotation and Continuous Grazing Over the Three Trials in 1969, 1970, and 1971

	Per head			Per acre		
	Rotation	Continuous	Difference	Rotation	Continuous	Difference
Total expenses	$165.52	$159.22	$ 6.30	$279.18	$265.86	$ 13.32
Income—						
Cattle	$198.08	$185.71	$ 12.37	$326.46	$304.98	$ 21.48
Hay	14.68	9.62	5.06	22.66	13.20	9.46
Total	$212.76	$195.33	$ 17.43	$349.12	$318.18	$ 30.94
Net returns to land and management	$ 47.24	$ 36.11	$ 11.13	$ 69.94	$ 52.32	$ 17.62
Expenses less animal costs	$ 30.52	$ 28.68	$ 1.84	$ 50.89	$ 44.72	$ 6.17
Weight gain, lb.	221	193	28	345	295	50
Cost/lb. gain	13.8¢	14.8¢	1¢			

spectively. These returns gave rotation grazing an advantage of $11.13 per head and $17.62 per acre per year.

3. The cost of producing one pound of weight gain averaged 13.8¢ for rotation grazing and 14.8¢ for continuous grazing.

4. Over the three years reported here, the rotational system produced a total of 1,035 pounds of weight gain per acre while the continuous system produced a total of 885 pounds. The total returns to land and management over the three-year period were $209.82 and $156.96 per acre for rotation and continuous grazing, respectively.

DISCUSSION

The results reported in the previous section from three grazing trials with stocker cattle on Coastal bermudagrass pastures demonstrate two facts that are important to Louisiana cattle producers. First, with a well-managed forage production and utilization program, Coastal bermudagrass produced satisfactory and profitable weight gains on stocker cattle—both calves and yearlings. Second, the rotation grazing system used in these trials produced larger and more profitable weight gains than continuous grazing, primarily because rotation grazing resulted in greater weight gains after July 1. The following discussion may explain some of the reasons why a sound forage management program is necessary to more nearly attain optimum utilization of the forage producing potential of Coastal bermudagrass.

Coastal bermudagrass is a warm-season perennial plant. It begins its growth as temperature begins to rise in the spring and, with an adequate supply of plant food, makes very vigorous growth during the spring and early summer. As the summer season progresses, there is a natural tendency for the plants to mature, resulting in a decrease in the quantity and quality of forage produced and, consequently, in a reduction in the weight gains of grazing animals. This maturing process can not be eliminated from the growth pattern of the plants. It was postulated, however, that management practices that would tend to keep the plants in a young, immature state of growth would delay the natural plant maturity and cause the growth of more desirable forage. Experience with haymaking from Coastal bermudagrass has shown this to be true. It was also postulated that delaying the maturing process in the Coastal bermudagrass plants would also tend to cause more desirable forage to be grown later in the growing season.

The results of the grazing trials reported here suggest that the rotation grazing system used, together with more precise haying, may

have delayed the maturing process in the plants. The cattle grazed under this system made significantly greater weight gains in two of the three trials. The larger weight gains made by the rotationally grazed cattle occurred during the period after July 1. The concentration of a larger number of cattle on a given area of Coastal bermudagrass probably resulted in a more complete utilization of the vegetative parts of the plants. The 10-day regrowth period following close grazing allowed the plants to recuperate and seemingly induced the production of more young, immature forage than was produced by the continuously grazed plants.

If the maximum forage producing potential of Coastal bermudagrass is to be utilized, it is necessary to apply nitrogen fertilizer periodically during the growing season. The application of nitrogen fertilizer stimulates the growth of the plants and an excessive amount of forage may be produced, especially during the first half of the growing season. If this forage is not removed, the plants will go into the maturing stage, seed heads will be produced, the leaves near the ground will begin to die, and forage quality will become low. Good management may require removal of the excess forage in the form of hay. The rotation grazing system lends itself to efficient hay making. When it becomes apparent that excess forage is being produced, the grazing can be confined to less than four paddocks. This allows excess forage in the paddocks being grazed to be controlled by grazing and allows the growth of enough high quality hay to justify harvesting in the ungrazed paddocks. This precision of hay making is not possible under a continuous grazing system. This fact was obvious in the data from these grazing trials, which show that more than twice as much hay was harvested under the rotation grazing system. This finding may indicate the need for smaller, but more frequent, applications of nitrogen fertilizer. It may also indicate the need for a heavier stocking rate of cattle to control the production of excess forage.

While Coastal bermudagrass is more resistant to the effects of dry weather than most warm-season perennials, the plants do tend to decrease vegetative growth and go into the maturing stage in response to insufficient moisture. In North Central Louisiana, the rainfall during the summer growing season is often below average due to insufficient rainfall during July, August, and September. This fact is shown in Table 12, which compares the average monthly rainfall for the 20-year period immediately prior to 1969 and the actual monthly rainfall for 1969, 1970, and 1971. Rainfall during the months of July, August, and September was below average in 1969 and 1970. In the grazing trials in these two years, rotationally grazed cattle produced greater weight gains during these three months than continuously grazed cattle. The differences in weight gains between the two grazing systems can not be attributed to weather. It is postulated

TABLE 12.—Twenty-Year Average and 1969, 1970, and 1971 Rainfall for the Spring and Summer Grazing Season

Month	Rainfall, inches			
	20-year avg., 1950-69	1969	1970	1971
April	5.58	4.53	5.33	1.45
May	5.32	3.74	6.82	4.30
June	3.62	1.03	2.23	2.69
July	4.36	1.77	4.01	7.65
August	3.26	1.66	1.76	5.22
September	4.20	1.26	2.77	4.16
Total	26.34	13.99	22.92	25.47

that the greater weight gains of the rotationally grazed cattle resulted from more or better quality forage. The plants being grazed under the rotational system seemed to suffer less stress from marginal moisture. This may have been caused by the 10-day period of regrowth free from grazing. It was observed during August and September in both 1969 and 1970 that most of the new leaf growth on the continuously grazed plants was generally less than one inch in length. During this same period, it was observed that the rotationally grazed plants had produced new leaves that were two to three inches in length by the end of the 10-day regrowth period. The deficiency in new leaf growth on the plants being grazed continuously likely was due to the uninterrupted grazing pressure on plants growing under physiological stress since all other environmental factors were as nearly the same as could be established.

Table 12 also shows that the rainfall during July, August, and September of 1971 was near or above the 20-year average for these months. There was no significant difference in the weight gain of the cattle on the two grazing systems in 1971. These observations seem to indicate that when there is ample moisture during this part of the summer grazing season, the continuously grazed plants are not subjected to physiological stress and the maturing process is delayed. The results obtained in the 1971 trial may indicate that rotation grazing is superior to the continuous system only in years when rainfall in July and August is deficient. Weather records at this station show, however, that July and August rainfall was below the 20-year 1950-69 average more than half those years. Rotation grazing seems to be good insurance against unprofitable weight gains on stocker cattle in years with insufficient late summer rainfall.

SUMMARY

Three trials were conducted grazing stocker calves and yearlings on Coastal bermudagrass pastures during the 1969, 1970, and 1971 spring and summer grazing season. The purposes of the trials were to evaluate Coastal bermudagrass as a forage plant for stocker cattle and to compare the weight gains and returns produced by continuous and rotation grazing. Under the continuous system all the forage in the pasture was available for grazing at all times. In the rotational system used, the pasture was crossfenced into four paddocks of equal size. The cattle were grazed on only one paddock at a given time and were systematically moved from paddock to paddock so that each was grazed 3 days and allowed 10 days for regrowth. The same stocking rates were used on the two grazing systems.

The results obtained from the three grazing trials show the following important findings:

1. Rotation grazing is superior to continuous grazing over a period of several years. In two of the three years covered by this study, the grazing system utilizing four paddocks and a three-day-on–ten-day-off rotation produced larger animal gains and a greater net return than was obtained using similar cattle on the continuous system. The continuous system produced equal or larger weight gains before July 1 in all three years but was definitely inferior after July 1 in two of the three years. Rainfall after July 1 in these two years was below average. During the third year, when rainfall after July 1 was above average, there was no significant difference in seasonlong animal gains for the two grazing systems.

2. The three-year average weight gains per acre were 345 pounds and 295 pounds for the rotational and continuous grazing systems, respectively. The average weight gains per animal were 221 and 193 pounds.

3. The cost of producing one pound of gain averaged 13.8¢ for rotation grazing and 14.8¢ for continuous grazing over the three trials. The cost per pound of gain was largely determined by the amount of gain produced per acre. This cost was greatest in 1969, when animal gain was smallest. In 1971, when the largest animal gain per acre was obtained, the cost of producing one pound of gain was 8.3¢ for both grazing systems. These production costs compare favorably with the gain costs for similar cattle grazed on winter pastures.

4. The average net return to land and management over the

three years was $69.94 per acre for rotation grazing and $52.32 for continuous grazing.

5. These grazing trials indicate that the grazing of Coastal bermudagrass with stocker cattle can be profitable and should be considered by Louisiana landowners as an efficient land use alternative.